BOTANICAL GAZETTE.

VOL. X. AUGUST, 1885. No. 8.

Notes on Carex —V.

BY L. H. BAILEY, JR.

1. To sustain the disposition which I made in the June GAZETTE of *CC. trichocarpa*, *aristata*, and *læviconica*, I submit drawings of perigynia and pistillate scales from various specimens in my collection. I have little confidence in the pubescence of the perigynium as a specific character. It is generally very variable in different individuals of a species, and, in some cases, *e. g.*, *CC. triceps* and *cinnamomea*, it disappears with age. In *CC. trichocarpa* and *aristata* it is entirely inconstant. Nevertheless, in the perigynium are to be found the most constant characters to separate these plants. Typical variety *aristata* differs from typical *C. trichocarpa*, as follows: Culm stouter; sheaths hairy; staminate scales awl-pointed and lax; pistillate spikes heavier; pistillate scales awl-pointed, narrow at base, equaling or exceeding the perigynium; perigynia smooth, somewhat coriaceous, rather narrow and abrupt at the base, long and gradually beaked, teeth setaceous and spreading. The size of the plants is wholly unreliable as a specific character; the hairiness or smoothness of leaf-sheaths is by no means constant; there are very numerous and complete gradations from the one to the other in shape and disposition of staminate scales. There is every gradation in size of spikes. The perigynia present the only characters worth especial consideration. I have in my possession every gradation of size, shape, texture and hairiness of perigynia from one extreme to the other. *C. trichocarpa* should have hairy perigynia and smooth sheaths, while *aristata* should have smooth perigynia and hairy sheaths. I often find specimens with both perigynia and sheaths smooth, and conversely, specimens sometimes occur with both perigynia and sheaths hairy.

The figures illustrate a few of the variations of the perigynia and pistillate scales. Fig. 1 represents a perigynium, and Fig. 2,

a scale of typical *C. trichocarpa* from Illinois. The perigynium is very broad, short-beaked, and densely setose-hairy. Fig. 3 shows *C. trichocarpa* with only a trace of hairiness and the long scales (Fig. 4) approach var. *aristata*. The shape and appearance of the perigynium is decidedly like var. *aristata*. This plant is robust, and has much more the appearance of the variety than of the species. It might with equal propriety be referred to either. The sheaths are smooth, or nearly so. The specimen figured is from Nebraska, but a similar form is common here at Lansing. Fig. 5 is the typical var. *imberbis* from Illinois. It has the scale of *C. trichocarpa* and the perigynium also, with the exception of the smoothness; sheaths scabrous. Fig. 6 is also var. *imberbis* from Illinois. Both perigynium and scale (Fig. 7) are nearer var. *aristata* than the species. Fig. 8, from Michigan, is nearly like the last only that the sheaths of the plant are hairy. This hairiness throws it into *aristata*, but the scale is nearly that of *C. trichocarpa*. Fig. 10 represents Dewey's old var. *turbinata* from New York. If the sheaths were hairy it would make a better *aristata*. Fig. 12 pictures C. A. Meyer's *C. orthostachya* from Russia. The smooth perigynium and hairy sheaths throw it into var. *aristata*, but the form of the perigynium is nearer the species. Fig. 13 is the var. *Deweyi* (*C. laviconica*, Dew.), which is smooth throughout. This variety is distinguished from both *C. trichocarpa* and var. *aristata* by its hard, polished, and almost nerveless perigynium, and by general habit. It passes by all gradations into both the species and the variety, however. Fig. 15 is from a plant of *aristata* with the typical robust habit, hairy sheaths, long spikes (4 in. long!), very loose and long staminate scales and awl-toothed perigynia, but the perigynia are hairy. This specimen is from Oregon. Fig. 17 represents pretty good *aristata*, but the whole plant is smooth!

2. CAREX COMPACTA R. Br., Sill. Journ., 1835, p. 39. Prof. John Macoun sends me this interesting arctic species from Nottingham Island, Hudson's Straits. (Fig 19.) The species is closely allied to *C. saxatilis* L., but differs in habit and especially in the *closely packed, conspicuously squarrose and much inflated perigynia*. From a study of authentic specimens in Herb. Gray, I am prepared to say that this species and *C. membranacea* Hook., are the same. My friend, Arthur Bennett, of Croyden, Eng., sends this note:

"*C. compacta* R. Br., is
C. hymenocarpa Drej.
C. membranacea Hook.
C. ampullacea var. *borealis* Lange.

Fide Herb. Hooker and Boott at Kew."

Carex compacta inhabits arctic America, and it is apparently rare.

EXPLANATION OF PLATE VIII.—1–18, *C. trichocarpa* and *vars.* 19, 20, *C. compacta.* 1, Perigynium of typical form, Illinois. 2, Pistillate scale of same. 3, With smooth perigynium and long scale, 4. 5, Perigynium of typical var. imberbis, Illinois. 6, Same of var. imberbis approaching var. aristata. 7, Scale of same. 8, Perigynium of var. imberbis, Michigan. 9, Scale of same. 10, Perigynium of var. turbinata, New York. 11, Scale of same. 12, "C. orthostachya" (C. A. Meyer), Russia. 13, Perigynium of var. Deweyi. 14, Scale of same. 15, Hairy perigynium of var. aristata, Oregon. 16, Scale of same. 17, Perigynium of smooth var. aristata. 18, Scale of same. 19, Entire plant of C. compacta. 20. Pistillate scale of same.

An Autobiography and Some Reminiscences of the Late August Fendler. III.

EDITED BY WM. M. CANBY.

His old habit of meteorological observation was kept up with unfailing regularity. He writes: "The evenings, mornings and nights are delightfully cool—the thermometer standing at 73°–80°, and generally clear. The heat of the day attains its maximum at noon, when the mercury usually rises to 94° or 96°. We make five thermometric observations every day at 5:30 and 7 A. M., 12 M. and 2 and 8:30 P. M." This industry and exactness, traits of character so unusual among the population of Trinidad, combined with the daily drying in the sun of botanical papers, an occupation which, as many botanists know, excites the wonder and amusement of people claiming a more enlightened civilization, soon rendered the brothers liable to a suspicion that they were engaged in counterfeiting or some other illicit business. In consequence their house was taken possession of and searched by the not over-gentle police, who even dug over their garden. It was a severe trial to the scrupulously honest man. "That this little affair weighed heavily upon my mind and gnawed deep into my immoderately sensitive feelings, you may well imagine," he wrote soon after. After some time he again wrote: "Not minding more than I can help the people around me, I go on improving my little property, setting out lots of Yams, Tanias and Bananas, and putting in cuttings of different ornamental shrubs and roses, also a weeping willow; raising from seeds Rondeletia, Coxcomb, Zinnias, Pinks, Petunias, etc., etc., to remind me of my former more northern home."

The promiscuous population of Trinidad afforded Fendler much interest and amusement. He contrasted the large Coolie population with the New Mexican Indians he had formerly known, finding many points of resemblance in character and habits. Among the latter he notes particularly the well known one of taking a whiff or two from a pipe and passing it on from one to another. But to one so honorable there was much also to cause pain. A short extract will throw some light on his habit of thought. "The observer of mankind finds in this Island much to interest him, but to me it is a source of pain to see the dense swarms of humanity full of tricks and deception * * * * with indecent haste trying to cheat and undermine each other. It is only when getting among 'the high woods,' in places where the single individual finds him-

self almost lost between the boughs and leaves of nature's fairest objects, that I feel happy again and forget the folly and rancor of the surging multitudes not far off." His garden prospered under his loving care, and he wrote enthusiastically of his flower beds and noted accurately the yield of his fruit trees. "A few days ago our Mango tree yielded the last of its fruit, giving us in all 426 mangoes of about half a pound each." At another time he says: "The Mango tree gave 438 mangoes up to August 11, and more to ripen soon. One orange tree furnished 1,006 sweet oranges. Fewer in number were the Plantains and Breadfruits, of which we have become quite fond."

Much of his time was given to botanical excursions and collections, often giving him much pleasure.

He writes to Dr. Gray: "Let me give you an account of one of these excursions. As the railroad train which is to take me to St. Josephs (six miles east of Port of Spain) does not start before 7 A. M., I need not rise earlier than 4 o'clock. Then preparing breakfast, and getting things all right, I start from home at six, walking one and one-half miles to the railroad depot, and arrive at St. Josephs at half-past seven. From St. Josephs I have to walk six miles up Maraccas valley in a northern direction, the road crossing the unbridged river nine times and rising gradually all the way to the foot of the mountains (where I get by about ten o'clock), and for three miles farther the road passes through small cacao plantations where nothing is to be collected in my line of business. Where the steep declivities begin the plantations cease and the primeval forests are entered. Searching for specimens to the right and left I reach at length, three miles farther on, the place that leads over the mountain ridge and down the other side towards the Caribbean Sea. By the time I get to the top of the ridge it is about two or three o'clock in the afternoon. By this time the most interesting region has been reached and the search for specimens is redoubled. During the excitement of searching and gathering, the flight of time is not heeded, and before, in scrambling downward, I have made three miles headway, I am reminded by the lengthening shadows, that it were best soon to look for a resting place for the night near some suitable tree or rock. In the dry season, when the sky promises to be serene for the coming night, I make a heap of dry, or nearly dry leaves close to the base of the tree against which I am going to lean. The tree ought not to be far off from a running stream, so that I may not lack a supply of water which, with a few biscuits steeped in it and a piece of cold meat, makes up my supper. This barely finished, the shades of night settle fast around me, the transition from day to night and from night to day, being so sudden in these latitudes that the darkness of night is upon one before he is aware of it. Horse-flies and mosquitoes are very eager for attack towards evening, but as soon as it has turned dark they are gone. Nevertheless I do not fail to hang a piece of mosquito-netting over my head and face, to protect myself against the attacks of a species of big bats called 'vampires,' and now, with no one to talk to, commences the long, lone watch of the night, for sleep it can not be called. Over head in the tree tops the stars twinkle through a few open places, but all else around is hid in shade and darkness; even the moon's softening rays are not allowed to enter the dark recess. At times, when the wind rises, the boughs of the higher trees utter a doleful whisper, and from afar comes up the hollow, dull, yet angry moan of the distant surf from some of the coves of the coast, which but a few hours ago glittered so lovely in the glare of the setting sun. But with the night wind dying away all is hushed again, save the low gurgling sound from the rolling waters of the rivulet near by and the never-ceasing notes of the cricket. In this way one long hour is passed after another, and the question suggests itself more than once—what time of the night? Whenever for the second time the subdued voice of the owl is heard answering one another, then there is reason to hope that dawn of day is not far off. * * * * As soon as

daylight peeps through the branches, I rise from my heap of leaves, the dry splinters brought with me from home are kindled, and, in addition to a few grains of quinine, a good cup of strong coffee without sugar soon revives my chilly frame. Having packed up my things, I again scramble along river and ravine gathering ferns and flowering plants. Thus occupied I turn gradually homeward in a round about way. * * * * This is all very well in dry weather. But in the rainy season it is not quite so pleasant. * * *"

But these excursions were sometimes not unattended with risk if the following is to be believed: "It is well known that in Trinidad there is no scarcity of serpents, but I was not prepared for the following which I read the other day, and which happened in a remote district near a cacao plantation, hidden and isolated in the midst of extensive, low and level primeval forests, where shade and dampness reign forever, and where, at times, I roamed about and had the pleasure of gathering many a rare fern: 'On the 9th of December some men, at work in a cacao plantation, on the river Manco, belonging to Mr. Augustine, heard cries of alarm. On reaching the spot from whence the cries had come, they saw a man enveloped in the folds of a monstrous serpent. They were not sufficiently armed, but presently returned in larger numbers, and with cutlasses chopping the snake through at several of the folds, killed it and disengaged the man's body. The man was dead and was stretched by the enormous pressure of the serpent's embrace to the length of seven feet.'" Whether Fendler thought this a mere "snake story" or not, he prudently concluded, "Now, however, if I go to these and similar woods again, I shall take along a more effective knife than the one I usually carry."

Here is the relation of another event which may serve to illustrate the character of the people by whom he was surrounded: "Having ascended one of the highest ridges of the Saut d'eau mountains, about ten miles from town, I took occasion to visit a man known all about as Popo Fernand (though his real name is Joseph Isodore), in order to inquire of him about a piece of land that was offered for sale in his neighborhood. On my way thither I was astonished to find that in and beyond the village of Maraval every man, woman and child knew where the man lived, though his cabin was miles away in the mountains in an out of-the-way place. When I at last reached his premises I found no one there, but noticed, as something unusual, a great number of beehives stuck all around his cabin and outhouses, the first beehives I have seen in Trinidad. After a while a woman came up and called aloud Fernand's name. He soon made his appearance. Neither he nor any of his neighbors could speak English and I could not speak their language. * * * * The man seemed, however, to be courteously disposed. In order to see how the land lay, I exposed my little pocket compass in his presence, when at once he seemed to become alarmed, and made me understand that he thought the instrument was intended to show the spot where money was hid in the ground. Of this notion I tried to disabuse him. Soon after he invited me into his room and, as is customary here, he asked me * * * to help myself to the contents of a small bottle he set before me. Not to show any signs of distrust, I poured out about two thimblefuls of the liquor, mixing it with plenty of water, but became somewhat suspicious after drinking it on noticing that Fernand himself had not taken any of the bottle's contents. About ten minutes later, on my way back, I experienced a strange state of mind such as never before I had happened to be in. There were neither dizziness, stupefaction nor exhilarating symptoms. Visions and strange incoherent thoughts flashed across my mind continually and vanished at once as quickly as they came. Any theme I made an effort to think upon slipped from my memory, and instead thereof quite a different theme presented itself with the same futile result, until I became frightened at my own thoughts and terrified at my condition of mind. After a two hours brisk and steady walk this unpleasant irritation of mind gradually subsided. * * * * What would have been the result had I taken a little more of that liquor?"

Sufficient has been written to show what manner of man Fendler was. It has been more than eighteen months since the writer heard directly from him, and now only the bare fact of his death is known, letters of inquiry directed to persons in authority at Port of Spain remaining unanswered. Those who have been privileged to become well acquainted with him will not soon forget this kindly, simple, honest-hearted man, nor cease to regret that they can no longer enjoy his friendship and correspondence.

On the Perforation of Cells and the Continuity of Protoplasm in Vegetables.

[A note by M. L. Olivier, presented to the French Academy of Sciences by M. Duchartre (*Comptes Rendus*, Tome C, No. 18, May 4, 1885).]

TRANSLATED BY ERWIN F. SMITH.

I. Three years ago I stated* that photography applied to microscopy was capable of showing details of structure which do not impress themselves upon the retina. In support of this assertion, I published† a description of a negative in which may be seen on the cell walls a system of markings and perforations inappreciable with the microscope.

In seeking to perfect this new method of investigation, I have confirmed the existence in vegetable cellular membranes of a system of canals to which I desire to invite the attention of the Academy.

In examining the living tissues of plants, whatever be the magnifying power used, we generally perceive no communication of one cell with another.‡ The small protoplasmic masses which constitute the living matter of each cell have also been considered, up to a recent date, to be absolutely independent and entirely isolated from each other; each one of these little masses appears in fact to be completely enclosed in an alveolus.§ From this view arises the impossibility of attributing to two neighboring protoplasmic masses any other relation than that of osmotic exchange through the solid walls which separate them. Such has been the general conception of the vegetable organization as depicted in the most recent standard works.

My researches have led me to an entirely different result. In

---

* *Revue Sci.*, April 8, 1882, 3d series, vol. iii, p. 433.

† *Ibid.* p. 434, and note on p. 435.

‡ Except in the case of sieve tissue of which the wholly special structure and localization in the plant are to-day well understood.

§ The walls of this prison are composed of a ternary substance; cellulose, lignine, cutine, etc.

the substance of the membranous walls I have observed numerous canals and have ascertained that they insure the continuity of the protoplasm through the cell walls.*

II. The existence of these extremely tenuous canals, which traverse the cell walls through and through, escapes detection by the ordinary methods of investigation, but may be shown by the employment of the following methods:

1. *Photography.* Thin cross sections are made of living tissues, after growth has ceased. The sections are then photographed *direct* with a magnification of about 300 to 700 diameters. By using for this operation the method I have already described †, we obtain negatives of a peculiar interest. On these negatives, when examined with a lens, the cell membranes appear to have an extremely complex structure‡; they are seen to be variously perforated by canals, transverse or longitudinal, which establish a communication between the contents of the cells.§ It seems impossible to ascribe this appearance of canals on the photographic film to any phenomenon of diffraction.

2. *Direct observation.* After having shown this structure upon my negatives, even upon old negatives which had not been made with reference to the study of cell membranes, I have tried to see it directly. To this end I have examined my preparations, with powers of from 700 to 900 diameters, in a dark chamber into which the microscope projected in such a way that my eye was influenced only by the light proceeding from the instrument. Under these conditions I have succeeded in seeing clearly the interruptions of the cell walls in several plants.|| Nevertheless, for the most part, this method is wholly insufficient.

3. *Staining sections.* I have obtained a better result by staining in an exclusive way, by means of appropriate reagents, either the cell membranes, or the protoplasmic elements after fixing, turgescence, or contraction. In the first case the cell walls, when

* In 1880, M. Tangl described perforations in the cell membrane of the endosperm of *Strichnos*, *Phoenix*, *Areca*. In 1881, in my "*Recherches sur l'appareil tégumentaire des racines*," I noted monocotyledonous tissues in which the cells communicate with each other by means of narrow canals. M. Strasburger, M. Russow (1882), M. Gardner (1882-3), M. Schaarschmidt (1884), have observed in various tissues, and especially in the albumen of a large number of grains, a similar arrangement, and have demonstrated it by means of staining materials.

† *Recherches sur l' appareil tégumentaire des racines*, Appendix; and *Revue Sci.*, vol. iii, p. 429 *et seq.*

‡ *Lappa communis*, var. *major*, *Ruyschia Souroubea*, *Clusia Liboniana*, *Buxus sempervirens*, *Ruscus aculeatus*, etc.

§ These canals therefore differ totally from the *culs de-sac* in thick membranes which are often described under the defective name of canaliculi.

|| *Triticum vulgare*, *Scindapsus pertusus*, *Tornelia fragrans*, *Raphidophora pinnata*, *Ficus elastica*; *F. carica*, *Buxus sempervirens*, *Amorpha glabra*, *Cytisus alpinus*, *Robinia viscosa*, *Lunaria annua*, *Jasminum humile*, *Anthurium nitidum*, *Smilax excelsa*, *S. rotundifolia*, *Agave glauca*.

observed under the conditions just indicated, present here and there colorless lacunæ, at least in certain species of plants. In the second case, the walls of the cells are seen to stand out white upon a colored ground; the canals which traverse these walls are then visible because they are colored the same as the fundamental protoplasm itself.*

4. *Injection into organs.* I also tried to inject (slowly under pressure) into the organs to be studied a liquid capable of coloring the protoplasm; I then made cross sections of these organs The injection rarely succeeded, but when it took place in a sufficiently uniform manner, this process led to a result identical with the preceding.†

IV. This unity (*ensemble*) of facts shows at least that in a great number of cases the cell walls permit the passage of protoplasm through narrow openings; so that in the tissues of a given plant, where up to a recent date we have only observed a multitude of small protoplasmic masses entirely isolated, there is in reality a single enormous protoplasmic mass.

It has seemed to me especially interesting to prove the existence of this structure in various parts of the same plant. For this purpose I have employed the box (*Buxus sempervirens*). Applying the methods 1, 2, 3, above mentioned, I have proved a continuity of the protoplasm in the stem and in the leaves of this shrub. From my investigations I am led to believe that in this species the protoplasm pursues, through incomplete cell walls, an uninterrupted course from the roots to the extremities of the leaves. *Ficus elastica* shows an analogous structure. The bearing of these facts on vegetable physiology and on natural philosophy will be considered in the near future.

[NOTE.—An English rendering of Dr. Schaarschmidt's paper "On the *Continuity of Protoplasm*," etc., may be found in *Nature*, Jan. 29, 1885, pp. 290–292. See also, *Nature*, Feb. 12, 1885, p. 337; Feb. 26, p. 390; and March 19, p. 459.—TR.]

GENERAL NOTES.

Esculent Plants of the Aborigines.—We are apprised that M. Paillieux, one of the Councillors of the French Society of Acclimatation, aided by M. Bois of the Museum of the Jardin des Plantes, are publishing a work on rare and curious esculent plants, and are anxious to bring as many of these as possible into cultivation in France. A request has reached us for seeds, bulbs or tubers, according to the species, of certain of our Western plants which the Indians use, or have used. By circulating the request in the BOTANICAL GAZETTE

* I have colored especially: *Triticum vulgare, Ficus elastica, Buxus sempervirens, Robinia viscosa, Cytisus alpinus, Amorpha glabra.*

† *Cytisus alpinus.*

we may hope that it may meet with botanists or amateurs who will cheerfully contribute what they may. The list leads off with *Asclepias tuberosa*, the roots or shoots of which are said to have been eaten by the Sioux at the Upper Platte. One need not go so far for this, and, indeed, it should be obtained through *the trade*. Nor should it be difficult to get the fleshy roots of the common American Arrow-head, *Sagittaria variabilis*, though it might not so readily be had under its Chippewa name, *Wah-es-i-pinig*. Among those asked for are the *Lewisia rediviva*, *Valeriana edulis*, the various species of *Peucedanum* of the Idaho region, which the Indians eat the roots of, as also those of *Edosmia* (now *Carum*), those of *Balsamorrhiza incana* and *helianthoides*, of *Callirrhöe*, *Scorzonella* (section of *Microseris*) and of *Calochortus luteus*, also the seeds of *Œnanthe sarmentosa* (we fancy a poor substitute for celery), and of *Rumex hymenosepalus* (probably a poor pie plant), which abounds throughout southern California. The address of A. Paillieux is 21 Rue du faubourg Poissonnière, Paris.—A. G.

The Investigation of Plant Diseases.—At the convention of influential agriculturists convened at Washington on the 8th and 9th of July by Commissioner of Agriculture Colman, the subject of plant diseases received considerable attention. There is manifestly a strong feeling throughout the country among the more thoughtful cultivators that the subject is one of immediate importance, and that its study should be encouraged to a greater extent than at present. No man stands in a better position to give a decided and substantial impetus to this movement than the head of the Agricultural Department at Washington.

It is, therefore, very gratifying to those who have the subject at heart to find that Mr. Colman has responded cordially to the memorial of the committee of the American Association appointed last year to encourage investigations into the health and diseases of plants, and that he has already secured Prof. Scribner to take charge of this work in the Department. That the commissioner is in earnest in his efforts is further evident from the considerable space given the subject in his address at the convention. We make room for the following extracts:

"Observations and conclusions published upon the origin and causes of diseases in plants are valuable or otherwise, according to the knowledge of vegetable economy possessed by those who favor us with their opinions.

"I am aware that in studying plant ailments it is extremely difficult in many cases to decide between a cause and a consequence. This has led to serious mistakes, as, for instance, a recent recommendation to cut down, "stamp out" peach trees, otherwise the fungus growth known as leaf blister, which is seen on peach trees occasionally during the period of leafing, would spread and destroy all the peach trees in the country. This, like most other destructive fungi on plants, being a consequence of diseased leaves caused by unfavorable climatic conditions, could not be "stamped out" permanently unless peach culture should be abandoned.

"It is well known that the profitable culture of some of our best fruits is rendered very problematical on account of their liability to fatal diseases. The pear blight is an example. Many apparently conflicting opinions have been published from time to time in regard to the cause of this malady, some attributing it to fungi, and others to bacteria, but withal, no remedy is suggested by microscopists so far as I am aware.

"Then again we have the serious question of grape mildew, which is really the cause of so much perplexity in the culture of this fruit, and gives rise to many conflicting opinions regarding the value of varieties in different sections and localities. Only the kinds most resistant of mildew can be cultivated profitably over a large portion of the country.

"Millions upon millions of dollars are lost annually by the ravages of blights, molds, rusts, smuts, and other vegetable diseases, and agricultural colleges can do a noble work in determining their causes and prescribing remedies."

In the discussion of the subject by the convention Dr. Phares, of Mississippi, offered a resolution to petition Congress to fully equip the Department for the more effective investigation of the fungous diseases of plants. A resolution was subsequently offered to have the seeds of the department subjected to the critical inspection of an expert on their quality, purity and vitality, and Major Alvord, of New York, deemed it best to have the two resolutions united, which was done. We think, this, however, an unfortunate disposition of the matter, but yet hope something may be accomplished.

What is now needed, as it appears to us, is a well equipped laboratory with a corps of trained specialists, who shall also be permitted to study the diseases in those parts of the country which offer the most favorable conditions for their investigation in the field. To make the work entirely successful it should constitute a separate division or bureau of the Department on an equal footing with that of botany, entomology, animal diseases, etc., and might very appropriately be called the *bureau of plant diseases*. The co-operation of the agricultural colleges, experiment stations and private investigators could be secured, and great scientific and economic service be rendered the country.—EDS.

EDITORIAL NOTES.

THE UNIVERSITY OF NEBRASKA has established a botanic garden.

DR. KLEIN'S work on micro-organisms has been translated into French.

A WORK of 300 pages has just been published in Berlin on J. J. Rousseau as a botanist.

PROF. V. M. SPALDING has been detained from going abroad to study by the illness of his wife.

PROF. J. M. COULTER is engaged during the summer on geodetic work in the southern part of the state, near New Albany.

DR. O. J. OLSEN has received a grant of $250 from the Norwegian government with which to continue his studies on native edible mushrooms.

THE VACANT PAGE of the last number was due to a misunderstanding of the printers. The GAZETTE can ill afford to leave blank any of its much needed space.

A SMUT on cultivated violets, *Urocystis Violæ*, attacking the leaves and flower stems, has made its appearance in France, as we learn from the *Revue Mycologique*, and has proved very destructive.

PROF. CHARLES R. BARNES, of Purdue University, has been granted a year's leave of absence, and will spend the time at the Botanic Garden, Cambridge, Mass., in the prosecution of some special researches.

DR. WARMING, of the University of Stockholm, has received a call as professor of botany in the University and director of the botanic gardens of Copenhagen, Denmark, and will begin his labors on November 1.

WE TAKE PLEASURE in directing the attention of our readers to our advertising columns, which have never been better filled with what is needed in all departments of botanical research, and especially that of bacteria.

WE HAVE HAD the pleasure of examining slides prepared at Marpmann's Microscopical Institute, for which Dr. Theodore Hinrichs, of Baltimore, is agent, and find them thoroughly satisfactory, although not so elegantly mounted as those of some American preparers.

THE JUNE NUMBER of *Drugs and Medicines of N. A.* completes the account of Hydrastis, and has excellent illustrations of *Trollius laxus*, *Coptis trifolia*, *occidentalis* and *asplenifolia*. A map showing the distribution of *C. trifolia* and the illustrations of its histology are specially commendable.

A STATUE to Linnaeus was recently placed, with much ceremony, in the Humlegarden park at Stockholm, Sweden. It represents him at sixty, meditating, holding the *Systema Naturæ* and a bunch of flowers. He is surrounded by allegorical female figures representing botany, zoology, medicine and mineralogy.

PROF. W. W. BAILEY, of Brown University, is to deliver four lectures at Narragansett Pier on botanical subjects. The topics announced are "Laurels and kindred shrubs," "Ferns and their allies," "Insect relations to plants," "The South county flora." The first is to be given July 21 and the last August 11.

PROF. WM. TRELEASE, of the University of Wisconsin, will, in September, take charge of the new school of botany, founded by Mr. Shaw, in connection with Washington University at St. Louis. A laboratory is to be equipped at once, and we understand an assistant is also to be appointed. It is procable that the laboratory will, before long, be removed to the splendid gardens which have made Mr. Shaw and the city of St. Louis so well known. These magnificent gardens, together with the extensive arboretum and greenhouses, will offer almost unrivalled facilities for students when a laboratory, library and herbarium are placed in their midst. We do not doubt that Prof. Trelease will make the school as worthy as its founder's intentions are commendable.

AS THE TIME approaches for the meeting of the American Association at Ann Arbor, Mich., the promise of a full attendance of botanists grows better. In answer to a circular every western botanist who usually attends the meetings has signified his intention of being present, as well as many others, and also quite a number from the eastern States. A thoroughly interesting meeting is already assured.

Among the subjects that will be brought up at this meeting will be that of plant diseases. Papers upon any phase of the subject will be especially welcome.

All botanists are expected to register immediately after registering for the Association, and receive the badge of the Club, which entitles them to its privileges.

An excursion is to be given some afternoon by carriage, to members of the

Botanical Club only, to one of the most interesting collecting grounds of the region, giving an opportunity to see the country and to botanize throughout the trip. The long excursion for Saturday has not been definitely decided upon as we go to press, but whether it be to the Saginaw valley or along the Detroit river an opportunity will be afforded the botanists to make a detour for examining the vegetation and collecting. The excursion after adjournment to Mackinac island and Sault Ste. Marie will give a rare opportunity to see a new flora and enjoy a delightful trip.

The meetings of the Club will be held during the week, beginning on Thursday (and not on Tuesday, the 25th, as erroneously announced in the Permanent Secretary's circular). The time and place will be given in the daily programme, as well as all other announcements for the Club.

It will doubtless not be superfluous to say a little regarding the organization and purpose of the Club. It had its inception at the Minneapolis meeting in a desire to secure a larger attendance of botanists at the meetings of the Association and to promote more ready and cordial intercourse between those who did attend. It was expected that accomplishing this much would lead the way to the consideration of questions and measures of scientific and practical importance. The Club is not encumbered with constitution, by-laws or formalities. Only members of the Association who express an interest in botany are eligible to membership, and the only other requirement is registration. The meetings are held at such times as will not interfere with those of the Association, usually at 9 to 10 a. m., on Thursday, Friday, and the succeeding Monday and Tuesday.

It is earnestly suggested that only botanical papers of considerable weight and importance be submitted to the general Association, and that all others be read before the Club, which will give them quite as good a hearing and the certainty of a more earnest discussion.

CURRENT LITERATURE.

Neue Untersuchungen über den Befruchtungsvorgang bei den Phanerogamen als Grundlage für eine Theorie der Zeugung. Von Dr. Eduard Strasburger. 8 vo. pp. xii, 176. 2 plates. Jena: Gustav Fischer. 1884.

The improvement in the processes of staining has made it necessary to re-examine some of the more recondite points in the process of fertilization of the Phanerogams, and Dr. Strasburger has gone over the whole ground thoroughly for the purpose of following the nuclei of the pollen grain thence to the oosphere. This has led him to the revision of the theory of fertilization.

The work before us is divided into five parts, the first treating of the structure and development of pollen grains and tubes; the second of the modes of penetration of the tubes into the stigma and the style; the third of the fertilization in the Coniferæ; the fourth of fertilization in the Angiospermæ; the last and largest part is devoted to a statement of a theory of fertilization. The following are some of the salient points of his work:

I. Doubt is cast on the generally accepted homology of the vegetative cell or cell-complex in the pollen grain of the Coniferæ and Cycadeæ with a rudi-

mentary prothallium, because the vegetative cells (when more than one) are cut off successively from the progamous cell. The proposition is then laid down that of the two cells formed by division in the pollen grain shortly before anthesis, the larger one is the vegetative and the smaller the generative cell, contrary to present nomenclature. It is found that there is in most cases a difference between the nuclei of these two cells in their capacity for taking up stains. Although in previous researches the nuclei had been thought to be sometimes absent in mature pollen grains, improved processes have demonstrated their presence in every plant examined. In ripe pollen grains the generative nucleus remains enclosed in the cell until the formation of the tube. In some cases the whole cell separates itself from the wall of the pollen grain, elongates and passes into the tube where it persists for some time. In other cases the generative nucleus divides while in the pollen grain, and this early division is characteristic of whole families, among which are mentioned the Graminæ, Cyperaceæ, Juncaceæ, Caryophyllaceæ, Umbelliferæ, etc. The vegetative nucleus never divides, notwithstanding such division has been claimed be Elfving to occur in Cyperaceæ. When the pollen tubes are formed a strong streaming movement of the protoplasm carries the nuclei into the tube. The protoplasm keeps near the end of the tube and is prevented more or less completely from returning to the empty part by plugs of cellulose, except in a few cases Usually the vegetative nucleus goes ahead, yet in many cases the generative one (or two) is first, and in other species sometimes one and sometimes the other. The generative nucleus in Angiosperms always divides once at least, and usually so in Gymnosperms. Both of the nuclei thus produced do not become destroyed, earlier negative results being due to imperfections in methods of research. The vegetative nucleus can be followed in monocotyledons to the ovule, although it frequently undergoes a surprising reduction in size. It is otherwise in dicotyledons. The vegetative nucleus disappears earlier or later in the pollen tube and only the two generative nuclei reach the ovule. This point is an important one; it strongly supports the claim that the smaller cell is the generative one; we must therefore consider the larger cell as the rudimentary prothallium in Angiosperms, a conclusion which increases the doubt as to the small cell or cell-complex of Gymnosperms being a prothallium. The author is somewhat inclined to consider the whole pollen grain of Phanerogams and the microspores of vascular Cryptogams as the homologues of the antheridia.

II. In studying the entrance of pollen tubes into the stigma several distinct modes were observed. The first case is that in which (in species of *Lilium*) the pollen tube grows downward on the one-celled club-shaped papillæ of the stigma, forces its way between their bases and enters one of the three narrow slits in which the canal in the style ends above. Through this canal, adhering to its walls in the mucilage formed by degeneration of the outer layer of the wall of the lining cells, they descend to the cavity of the ovary. In another case (*Atropa Belladonna*) the pollen grains drive their tubes between the cell-rows of the stigma and into the conducting tissue of the style which is arranged in several strands through it. In *Cereus speciosissimus* the conducting tissue surrounds a canal and the pollen tubes penetrate this and do not pass down the canal. In *Agrostemma Githago* the pollen tubes dissolve the walls of the elongated single-celled papillæ at the point of contact enter these cells and grow downward (though they sometimes make a mistake and have to turn on themselves) penetrate the bases of the papillæ cells and pass thereafter *between* the cells of the conducting tissue. The Malvaceæ behave in the same way as *Agrostemma*, though none of the rest of the Caryophyllaceæ agree with it. In *Anoda hastata* the pollen tubes penetrate the epidermal cells of the stigma (which are not at all prolonged, hardly even swollen) though the outer wall of these cells is somewhat cutinized! "[The pollen tubes] show in their be-

havior the same modifications as have been recognized for the penetration of the hyphæ of parasitic fungi into their hosts. The entrance of the pollen tubes *between* the cells of the stigmatic surface is most commonly observed and only in relatively few cases is their growth *into* the cell to be seen."

III. In the fertilization of the Coniferæ the most important morphological facts are clear. Differing from Goroschankin, Strasburger states that though he has seen numerous cases of copulation in *Picea vulgaris*, he has never observed more than *one* male pronucleus in this copulation. The second one is finally dissolved. The development of the oosphere of Abietineæ has been the subject of much controversy. The numerous nuclei of Goroschankin resolve themselves into vacuoles, according to our author. The nucleus of the central cell of the archegonium undergoes one division with which the formation of the canal-cell is connected. In Cupressineæ, as in all Gymnosperms, the male pronuclei enter the oosphere. They have previously been seen in the oosphere at various distances from the neck of the archegonium; lately they have been found at the extreme outer end of the oosphere, so that there is hardly a doubt that they have passed from the pollen tube between the neck-cells of the archegonium. The nucleus of the fertilized oosphere *clothes itself* with a layer of very large starch grains which disappear during its movement to the lower end of the oosphere or shortly thereafter. These starch grains were formerly thought to be inside the nucleus of the oosphere.

IV. In the fertilization of Angiosperms there remains only one step to be observed, viz., the passage of the nucleus of the male cell of the pollen grain into the oosphere. In many monocotyledons, especially Orchideæ and Liliaceæ, the transparency of the ovules and the comparatively large size of the nuclei in the pollen tubes renders the process much more easily observed than in dicotyledons, in which these two conditions seldom co-exist. The processes are, however, essentially alike in both. In the pollen tube the generative nuclei can be recognized even to the time when the tube enters the ovule. In those cases when the vegetative nucleus goes first (some monocotyledons), it is probable that it can and does copulate with the oosphere, though it has never been seen inside the integument of the ovule. When the pollen tube reaches the micropyle it penetrates to the embryo sac and inserts its apex between the caps of the synergidæ. One or both of the synergidæ then become disorganized, thus making way for the plasma of the pollen tube to reach the oosphere. The generative nuclei can then be seen between the synergidæ; one of them, the male pronucleus, penetrates the oosphere and fuses with its nucleus, the female pronucleus. The other soon becomes absorbed. The nucleoli of the male and female pronuclei likewise fuse, and a delicate cellulose wall is formed on the fertilized oosphere.

V. The author states his new theory of fertilization in three propositions which he considers well established.

1. The process of fertilization consists in the union of the male pronucleus with the nucleus of the oosphere, a statement which was first definitely formulated by O. Hartig.

2. The cytoplasm is not concerned in the process of fertilization.

3. The male pronucleus, like that belonging to the oosphere, is a genuine nucleus.

In confirmation of the last proposition it has been established by direct observation that, although usually the male pronucleus undergoes more or less important changes in its course to the embryo, thus casting doubt upon its nuclear nature, yet in some cases it proceeds without such changes even up to the time of copulation. When the nucleus meets with resistance on its way to the oosphere, there are coincident changes especially when surrounded by but little cytoplasm. The more the enveloping cytoplasm, the less change in the nucleus, the changes being reduced to their minimum in phanerogams.

The second proposition, which makes the protoplasm surrounding the pronuclei only incidental in the process of fructification, has given rise to much controversy. It is undoubtedly necessary to look to the angiosperms to clear up this important point. In the division of the progamous pollen cell the cytoplasm of the resulting generative cell, even when in the smallest quantity, is seen to be strongly defined. It is evident that this cytoplasm might possess procreative qualities if it retained its identity up to the time of copulation. But we find on the one hand that it is as good as consumed by the generative nucleus and so often quite disappears, and then on the other hand that the boundary of the cell may entirely vanish sooner or later. Just here a difference exists between gymnosperms and angiosperms in that the nucleus of the generative cell of the former only uses up a part of the cytoplasm of its cell, while the latter may consume it all. From this and other arguments it is concluded that the procreative power can not reside in the cytoplasm. The cytoplasm of the generative cell in gymnosperms and of the vegetative cell in angiosperms serves in part as a vehicle to transport the nucleus, and therefore performs the same office as the cilia of the antherozoids in the vascular cryptogams.

The first proposition naturally follows from what has been said, for if the cytoplasm is not concerned in fructification, the pronuclei—male and female—must necessarily be the agents. The author does not, however, rest the question upon this *reductio ad absurdum* proof, but proceeds to give with the greatest detail every item of the process of fructification with the accompanying changes. He then discusses many recondite questions connected with the physics and physiology of the process, bringing to bear the latest investigations of the similar processes in zoology, such as those of Balfour,* Nussbaum,† and Ed. van Beneden and Ch. Julin.‡ Over eighty pages are devoted to this theme, so packed with new and important matter that it is entirely impossible to give a profitable abstract in the space at command.

Die Pilzthiere oder Schleimpilze, nach dem neuesten Standpunkte bearbeitet. Von Dr. W. Zopf. Eduard Trewendt. Breslau, 1885. Roy. 8°., pp. 174. Illustrated.

In this exceedingly interesting work the author has given the results of his own earnest and patient labor and also quoted freely from the writings of De Bary, Cienkowski, Klein, Brefeld, VanTieghem and other investigators in the same field.

In his opening chapter he makes a comparison of the morphology of the Monadines with the morphology of the Eumycetozoa, and is led to the conclusion that the representatives of both groups are substantially similar in their early development, and that between them bonds of union exist.

In regard to the place of this combined group of Mycetozoa in the system of organic life, it occupies, without doubt, a peculiar position, a borderland between the animal and vegetable kingdoms, a view which the author has expressed in the words of the title. He also prefers on this account DeBary's term, Mycetozoa, to Myxomycetes, as being more literally correct.

The first division of the book is devoted to morphology and life history, giving in detail the development of individual members of the group from the germination of the spore through the successive stages of zoospores, amœbæ and plasmodium, and finally the matured zoocysts and sporocysts.

* Handbook of Comparative Embryology.
† Arch. f. mikr. Anat., Bd. xxiii.
‡ On the spermatozoids of *Ascaris megalocephala*, in Bull. de l' Acad. roy. de Belgique, ser. 3, vii.

In the second division is given the physiology of the group, which includes detailed accounts of the behavior of the plasmodium under light, electricity and various temperatures, and also when subjected to the influence of different gases and chemical re-agents. A chemical analysis of plasmodium of *Fuligo varians* (after Reinke and Rodewald), furnishes a large and curious list of component parts.

In the third division is the systematic classification with descriptions of one or more species of each genus represented. The heads of the author's classification are as follows:

A. Monadineæ.
  I. *M. azoosporeæ* Z.
    1. Vampyrelleæ. 2. Bursullineæ. 3. Monocystaceæ.
  II. *M. zoosporeæ* Cienk.
    1. Pseudosporeæ. 2. Gymnococcaceæ. 3. Plasmodiophoreæ.
B. Eumycetozoa.
  I. Sorophoreæ.
    1. Guttulineæ. 2. Dictyosteliaceæ Bref.
  II. Endosporeæ.
    a. Peritricheæ.
      1. Clathroptychiaceæ Rost. 2. Cribrariaceæ Rost.
    b. Endotricheæ.
      a. Stereonemeæ.
        1. Calcariaceæ Rost. 2. Amaurochætaceæ Rost.
      b. Coelonemeæ.
        1. Trichiaceæ Rost. 2. Arcyriaceæ Rost. 3. Reticulariaceæ Rost. 4. Liceaceæ Rost. 5. Perichænaceæ.
  III. Exosporeæ Rost.

As Rostafinski's classification of the Myxomycetes or Eumycetozoa was perhaps universally adopted after the appearance of his monograph, botanists will probably be interested in noting the changes suggested by Dr. Zopf.

As a result of some recent investigations, he deems it necessary to make changes in some of the groups founded upon the color of the spores. The orders and sub-orders, with some omissions, are otherwise substantially the same except the order Heterodermeæ, which is replaced by Peritricheæ, the sub-order Clathroptychiaceæ, being also included.

The following Rostafinskian genera are omitted: Protoderma, Cienkowskia Crateriachea, Chondrioderma, Echinostelium, Brefeldia, Heterodictyon, Siphostychium, Dermodium, Oligonema and Prototrichia.

While botanists may not question the wisdom of the abandonment of some of the above genera, it seems to be a rather vigorous use of the pruning knife to merge Chondrioderma with Didymium on the ground of similarity of capillitium, especially as Lepidoderma with the same character of capillitium is retained.

Two new genera are created, Æthaliopsis and Tubulifera, each with a single species.

The work is well illustrated with fifty-two wood cuts, mostly by the author, and is a welcome addition to the literature of the subject. GEO. A. REX.